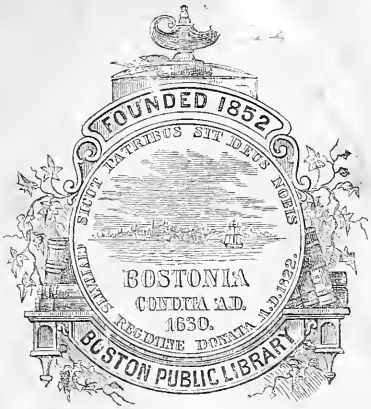

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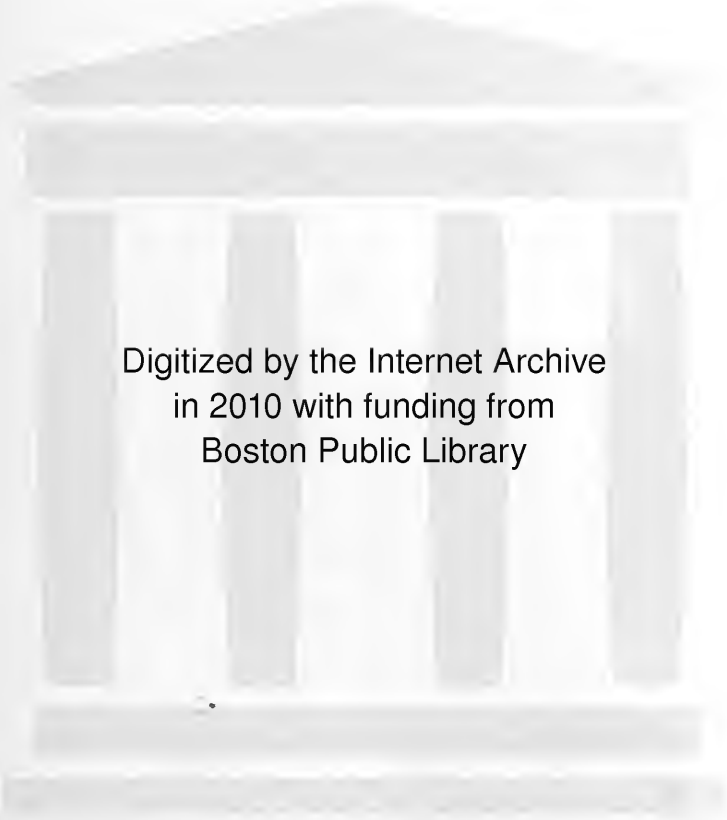

From the Fourth Report of the Vermont Board of Agriculture.

ON CERTAIN

INTERNAL PARASITES

OF

DOMESTIC ANIMALS.

By GEO. H. PERKINS, Ph. D.,
Professor of Zoology in the University of Vermont.

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It seems to be an universal rule, throughout the animal kingdom, that every animal harbors other and lower organisms, which draw their entire nutriment from the supplies of their host, and usually, in return, inflict more or less serious injury upon the structures they infest. Sometimes, hundreds, or even thousands of these uninvited and unwelcome guests, may exist within the body of an animal, and yet its health may be apparently good; but more often as the stock-raiser and dairyman too well know, the health is impaired, at least, if not ruined, and the animal destroyed.

The many species of external parasites are bad enough, but the internal parasites are far more dangerous and difficult to deal with, being not easily destroyed and multiplying with astonishing rapidity, so that before any efficient remedy can be applied, the animal is beyond the reach of any of them. A single tape worm may contain over 1,000,000,000 eggs, and other species are nearly, or quite, as prolific—some even more so. Man himself, when living under the ordinary sanitary conditions of civilized society, may not be infested with great numbers of parasites, but no one is sure of immunity from this evil, and if at any time free from parasites, he is, at any moment, liable to acquire them; still, under some conditions, these disgusting intruders are far more likely to be acquired than under others, and hence a knowledge of the subject is very important, though it be disagreeable.

But, if civilized man is comparatively free from parasites, savage man, and still more the lower animals, are often grievously afflicted by them, as may be seen from the following example, which is stated by a German author. A colt, two years old, that had been killed, was examined with care, and in it were found five hundred round worms (*ascari*); one hundred and ninety thread worms (*oxyuriæ*); two hundred and fourteen round throat worms (*strongyli*); several

millions of another round worm of the same genus; sixty-nine tape worms (*tænia*); two hundred and eighty-seven threadlike worms (*filariæ*), and six bladder worms (*cysticerci*).* Many of these worms were fully grown, and several inches long, while some were many feet. Very various in size and appearance are these parasites, some (as the tape worms) being long and ribbonlike; others, short and broad (as the liver flukes); others, like slender threads; others, nearly globular; some are wholly unseen by the unaided eye; others are many inches, or forty or fifty feet long; and in the *Popular Science Monthly* above referred to, mention is made of a tape worm eighteen hundred feet long. Some quite similar species of parasite have different habits: thus, the bot fly of the ox lays its eggs on the back of the animal, where they hatch, and the larvæ burrow into the skin, and cause little swellings, from which they come as perfect flies; while the horse bot fly lays its eggs on the knees or chest, whence they are taken by the mouth as the horse bites the parts, and pass into the stomach, and there hatch and become internal parasites, coming from the intestines only when about to change to perfect flies. The symptoms usually supposed to indicate the presence of bots, may be caused by the presence of foreign bodies, as calculi, or by true intestinal worms.

I can in the present paper speak only of a few of the more important internal parasites. Those which are found in man are, of course, most important, and next to these such as are found in the domestic animals, and, as we shall presently see, man is in many cases infested by the same or similar species of intestinal worms, as the domestic animals, with which he most intimately associates. In the following pages, those parasites that inhabit the sheep and cow will be chiefly considered. About twenty different species of internal parasites have been described from the cow and ox, and about as many from the sheep, and the horse harbors as many. Some of these are common to quite a number of different animals, while others exist only in a single species. Tape worms in the adult state are not common in cattle, and only two species have hitherto been found, and these but seldom, but in the immature or cysticercus state there is a species which is very common, and which produces "measly" beef; the mature state of this is found in man, and there are three other species found in the young state in cattle, which exist in the adult state in dogs.

As the mode of development of the tape worm is not familiar to all, and as it is quite curious, it may be well to briefly state its main facts. One or more species of tape worm is found in nearly all vertebrates; more than one species are most commonly found. Some animals seem more likely to be infested than others. The eggs of the tape worm are very minute, and may be scattered anywhere, but they only develop when they reach the stomach of some suitable animal. In this situation the outer somewhat tough and leathery coating of the egg is dissolved, and the embryos make their way into the blood and are borne through the circulatory system to different parts of the body, some being lodged in the muscles, some in the liver,

* Popular Science Monthly, vol. VIII, p. 677.

lungs, heart, brain or elsewhere, and if there are many, they give to the parts infested a spotted or mottled (measly) appearance in a short time, as they soon enclose themselves in a calcareous case or cyst, which renders their presence more evident. The embryo is at first cylindrical, but soon from the hind end a sac develops which is filled with liquid; in this condition the worm is called a bladder worm, or cysticercus. In this state it may remain a long time, for it can develop no further until it leaves the animal in which it has lived thus far, and enters the stomach of some other, and if this does not happen the cysticerci perish in course of time. If however a suitable host be provided, as in the case of the common pork tape worm, if man eats the infested pork, the cysts are dissolved in the stomach and the embryo worms set free, and development and growth go on.

In the bladder worm, or cysticercus, the head is of a more or less globular form and furnished with suckers. Behind the head is a short series of joints, which form a sort of neck, and then comes a spherical or pear-shaped sac. As this worm, freed from its confining cyst, passes into the intestines, it attaches itself firmly by means of the head-suckers, the sac drops off, and the joints begin to increase rapidly in size and number, become flat and thin, and this process may go on indefinitely until a great length is reached in some, while in other species it is soon arrested, and the entire length is but a few inches. As soon as the young worms locate themselves in any part of the body of an animal, they begin to burrow in its tissues, and this process causes inflammation, which is severe in proportion to the number of worms and the nature of the part affected. If there are but few, and these in muscle, no very noticeable results follow; but if there are many, and the brain or heart is affected, death may ensue. After the worm is mature, and the joints fully formed, each is sexually complete in itself, and capable of producing vast numbers of fertile eggs; and as these joints are liable at any time to break off and pass from the animal, and thus reach a locality where they can develop, every infested animal is likely to extend the trouble. As old joints break off, new ones may be formed, so that the loss of many feet of a tape worm is no advantage whatever to the host, unless the head passes away.

Thus we have seen that to produce a perfect tape worm, the aid of two animals of different species is needed, and we find a strange relation between many animals because of this fact. For instance, the two species of tape worm most often found in man, are found in the embryo state, one in pork, and one in beef. Of three tape worms found in dogs, one is in the embryo, or cysticercus state, found in sheep, one in rabbits, and one in cattle. A tape worm living as adult in cats, lives as cysticercus in rats and mice. One found adult in herons, lives as young in frogs, and so on—the animal eaten, harboring the immature, and the animal eating this the mature tape worm. The most common tape worm of man is *Tænia Solium* (Linn.), which comes from eating pork containing the same species in an immature condition, and if hogs swallow the eggs which pass from infested persons, they in turn become infested, and in a condition to injure whoever eats the pork that comes from them. Hence, under no circumstances should hogs have access to human excrement. The eggs of tape worms are

too small to be noticed, and pork which contains but few cysticerci is not so changed in appearance as to attract attention; hence unusual care is needful. If pork be *thoroughly* cooked, the cysticerci are destroyed. It is certainly true, that in no case is it safe to eat either beef or pork raw. Animals may be somewhat infested and yet be in apparent good health, so that the appearance of the animal is of little value as a guide in this matter. If a joint of a tape worm full of eggs lies exposed to the air, the eggs may be set free and blown about into exposed water, or upon fruits or vegetables. A tape worm living in the adult state in the dog, passes its immature stages in man, and if he swallows its eggs, it causes in him a most terrible disorder known as hydatids. On this account care should be exercised in using vegetables, such as lettuce or cabbage, that are eaten as taken from the garden. All such produce should be thoroughly washed before being used, certainly if dogs are abundant.

Cysticerci seem usually to be capable of producing more serious results than the mature tape worm, and this is emphatically true of one of these tape worms of the dog. This (*Tœnia echinococcus*, Sieb.) is a small worm, and a single dog may harbor many of them. From such a dog multitudes of eggs will pass, and, reaching the air, be blown about into exposed water or upon fallen fruit or vegetables. If these be taken into the stomach of a cow, sheep, pig, horse, or man, they hatch, and the very minute embryos, with their heads furnished with six little hooks, burrow through the walls of the stomach, and get into a blood-vessel, and are borne by the blood to some organ or muscle where they develope as bladder worms, and cause a sort of watery tumor. There may at first be but few, but by a sort of budding they increase rapidly. If such a tumor exists in the brain, insanity and probably death follows, and the results are always very dangerous in whatever part of the body they may be, and they are to be greatly dreaded. In most cases the disorder is beyond the reach of medical skill.

Prevention by lessening the number of dogs, filtering drinking water, and cleansing vegetables, is all-important. A very excellent sanitary measure would be one that should prohibit the feeding of slaughter-house refuse to dogs, for it is often from this that a dog is infested with more than one dangerous parasite. The hydatid tumors so fatal to man are also fatal to the animals above named. A parasite which is sometimes very common is the diving bladder-worm of sheep and cattle. This parasite, in the bladder-worm state, is globular or flask-shaped, two or three inches long, and two thirds as wide. The smaller end is split open, and from the cleft protrudes a cylindrical neck, terminating in a head furnished with four suckers. This head rises and falls in the globular part with much regularity, whence the name. This parasite is usually found in the cavity of the abdomen, attached to the liver or intestines, and when the animal is opened, falls off, looking like a sac. These sacs are eaten by dogs, and in them the mature tape worm (*Tœnia marginata*, B.) is found, and from them come the eggs which the sheep and cattle swallow with grass or water, and they cause inflammation, disease, and ultimately death. The mature worm is but a few inches long. Prof. Verrill says of this in his very valuable paper, published in the 4th Report

of Conn. Board of Agriculture, "When the young worms have once got into the system of a sheep, there is no remedy. In this case prevention is our only hope; and to this end the same means should be used as against *Tœnia cœnurus* and *T. echinococcus*. Especial care should always be taken to destroy the water-bladders and all other parasites observed in slaughtering animals, for in many cases the eggs are capable of retaining their vitality for many weeks or months. They should never be thrown aside as harmless, or even buried, but should be destroyed by scalding hot water or fire." Much may be done also, in diminishing the numbers of this and other parasites, by frequently doctoring those dogs that are worth keeping, or are necessary, in order to expel their parasitic worms, of which there are generally many kinds. What is known as "water brain" in sheep, is a disorder caused by the young of *Tœnia cœnurus* (Kuch), a tape worm adult in dogs. This has also been found, though but rarely, in cattle. The young worms burrow in the substance of the brain, having found their way there from the stomach through the circulation, and cause large, watery, sac-like tumors, which produce death; and if a dog eats the brain, or even gnaws the skull about it, of such an animal, he will swallow the immature worms, and they will develope in his stomach and produce eggs which, passing from his body by the intestines, may find their way into the stomach of the sheep, and it becomes giddy and staggers, and finally dies. As usually is the case with animals infested with tape worms in their immature state, there seems to be no remedy for this. When sheep once have the water brain, they are doomed.

Another group of parasitic worms, (*Trematodes*,) of very different appearance, contains some common parasites. To this group belong the flukes. The liver fluke is a long ovate worm, not quite an inch long and about half as wide. Near the anterior end is a cup-shaped sucker by which it can attach itself to any object, and in front of this is another and smaller sucker, at the base of which is the mouth. The color is brownish or greenish yellow. The body is very thin and flat. This liver fluke (*Fasciola hepatica*, Linn.) is found in many different animals, including man. The eggs are produced in large numbers, and such of them as chance to reach a damp, or moist location, hatch after a time into minute, conical bodies, covered with vibrating cilia, by means of which they swim about. In a short time the cilia drop off, and the embryo creeps about and fastens itself to the body of a snail and passes through certain transformations, another embryo being formed inside the first by a sort of budding. This has a more cylindrical form, and has a tail like a small tadpole. In this state the embryo leaves the snail to which it has been attached, and swims about in the water, but by and by it again seeks the snail and is fastened to it, and becomes covered with a calcareous shell, and in this condition may float in the water and be taken by sheep or cattle as they drink. Once in the stomach the cyst of lime is dissolved, and the freed worm finds its way to the liver, and there rapidly develops, produces eggs, and at length leaves the animal and perishes. From what has been stated, it will be seen that the flukes can develop only in damp places, and on this account those cattle that feed much in such places as swamps will be most likely to be infested. In sheep its presence is,

as is well known, often very fatal, causing what is known as "water rot," or "fluke rot," but when occurring in cattle, it does not appear to be fatal usually, but, of course, cattle are more or less injured by its presence.

When an animal harbors flukes in large numbers, it becomes weak, emaciated, and unsteady in its gait. There are only partial remedies. Salt given in abundance would be useful, and perhaps other substances may be discovered which will dislodge the intruder, but at present it seems necessary to wait until the worms let go their hold of their own accord and pass away from the animal; after this, if the animal is strong enough it may fully recover.

There are several species of flukes—two occur in the liver, one much less commonly than the other; another is found in the bile ducts of cattle, and another in the stomach.

Another group of parasites, and the last which will be mentioned in this paper (*Nematodes*), embraces numerous species of small, cylindrical worms, some of which infest the lungs and air passages of different animals; others are found in the intestines.

That which is most important, is *Strongylus micrurus* (Mehlis), which infests the air passages of cattle. This is a small, threadlike worm; the male being about an inch and a half, and the female, three inches long. It is found most commonly in young animals; calves a few months old are most troubled. This parasite increases so rapidly that the trouble may soon become epidemic, when it has once made its appearance. The eggs of the worm are coughed up by infested animals, and may thus reach the air passages of others. They are said to be very tenacious of life, and able to revive after being dried up for a long time, when placed in water.

In some places, this parasite has caused great mischief. In the adjoining State of New York, this parasite appeared in 1869, 1870, and 1871, in a number of localities, though confined to the calves on a single farm in each case, and for that reason no great destruction followed; but Prof. Verrill states that some of the worms sent him for examination, proved to be identical with the species above named, that in Europe has caused great mischief. The main facts in the history of this species are as follows. In the early stages, the worm lives in the lungs of the animal infested, and there they become encysted in some cases; in others, only hairs covered with a soft skin, growing harder with age. In the encysted condition they may remain for some time, the length differing in different species; but whenever they leave this state, they make their way along the air passages into the bronchial tubes, reaching as far outwards as the throat, sometimes in such numbers as to entirely close the windpipe and cause suffocation. If there are fewer, they irritate the air passages and cause coughing and sneezing, during which some may be thrown out and infest other animals. Moisture is especially favorable to the preservation of both the eggs and mature worms, and hence they are more likely to be troublesome in wet seasons than in dry, and animals that feed in damp, swampy places would be more in danger of being attacked by them than those pastured on dry ground.

As the parasite is easily scattered by animals infested by it, as soon as its presence in any animal is discovered, the animal should be im-

mediately and wholly separated from the rest. The symptoms of its presence are various, differing somewhat in different cases. Usually the animal at first appears to have some bronchial disorder; it coughs somewhat, though at first but little; the skin is dry and hair rough, and the creature grows thinner day by day as the trouble increases. All these symptoms are not especially characteristic; but a sure diagnosis is reached, if some of the mucus coughed up be examined, when the small, threadlike worms may be seen, sometimes scattered through it, sometimes coiled in little bundles. As the irritation from the presence of the worms increases, coughing grows more frequent and severe, and in bad cases, suffocation may take place during a paroxysm of coughing. In some cases, the cough is not at any time severe, but is loose and wheezing, and the animal grows weaker and weaker, and finally dies from exhaustion. The duration of life after the strongyli have fully taken possession of an animal, may be but a short time, or it may be several months, or the animal may recover. Sometimes other parasites are attacking the stomach, intestines, or other parts, at the same time that the strongyli are in the lungs and air tubes, and of course death ensues much more certainly and speedily in such cases. While an animal infested with strongyli may not be always incurable, yet prevention is better than cure, whenever it can be exercised. Besides complete isolation of any infested animal, it is best to avoid pasturing stock—especially if it be young—in pastures that have been occupied by animals having the parasites; and if the worms are known to exist in the region, it is best to avoid wet and swampy pastures. Water of brooks which have come from pastures where infested animals are feeding, may contain embryo strongyli. It has been proposed that pastures which have been occupied by infested stock be ploughed, and crops raised upon the land for one or two seasons, that all germs may be destroyed.

It is stated that in England in some places where formerly the strongylus was abundant in lambs, it is now kept in check by feeding these animals hay and roots during a wet season. Naturally any animals in sound, robust condition are better able to endure the attacks of parasites and to recover from their effects than others. Free access to salt is regarded as beneficial. As remedies for strongyli in calves or lambs it is recommended by Prof. Verrill and others to use inhalations of sulphurous acid, which "may best be administered by burning flowers of sulphur in a close house, but into which air can be readily admitted in case of need." "The sulphur fumes are to be evolved until the air of the apartment is impregnated as strongly as the administrator and his patient can bear without violent coughing. Breathing of the sulphur fumes should be kept up for half an hour, or as long as the air of the building remains impregnated with it, and should be repeated at least three days in succession. At the end of a week, should the patient survive, the smoking should be repeated to destroy the parasites which have been hatched in the interval. The same process may have to be repeated once more, though if the ova in the lungs are so numerous as to endanger life after this, the inflammation caused by their presence will probably speedily cut off the patient."* I should also think that carbolic acid might be successfully

*Report of Connecticut Board of Agriculture, 1871, p. 396.

used. A pretty strong solution of this substance may be placed in a shallow dish, and hot iron or stones dropped in, and renewed as often as needful, and in this way the air of a room may be kept saturated with carbolic vapor. What is known as gapes in chickens is caused by a species of strongylus, and other species infest sheep, hogs, and other animals, occupying different locations in the body. The common kidney worm of hogs, is a strongylus of much larger size than that above described, and this ultimately causes death by the destruction of the tissues of the organ in which it has located itself.

As has been seen, for many of the parasites mentioned there is no known remedy, as for disorders caused by the immature tape worm, while for the same species in the adult condition there are almost certain remedies. Mush made of pumpkin seeds often proves efficient in expelling the tape worms found in man, and oil of male fern is more sure, and the same remedies might be used in the case of animals. Such a parasite as the liver fluke, which after a time completes its growth and voluntarily leaves its host, will probably do comparatively little permanent injury to strong well fed animals. And such animals as are infested with intestinal parasites should have strong nutritious diet, plenty of roots, corn, oil cake, &c. Plenty of salt acts often as a vermifuge, and yet more sure is oil of turpentine mixed with milk. If a calf is strong and several months old, a tablespoonful can be given in the morning before food is given, and on the third day after, this may be repeated. Such treatment will be pretty certain to expel most if not all of those parasites which may be lodged in the stomach or intestines. I much regret that it has not been possible to present in connection with this paper illustrations of the more important species mentioned, nor can I now speak of the numerous and important parasites found in the hog, as well as those found in the horse, dog, and cat. Perhaps at some future time, the work I have begun may be more nearly completed. I am very well aware that the subject is an unpleasant one, but that it is one that it is very important for every one to consider, cannot be doubted.